DOCUMENT RESUME

ED 065 346 24 SE 014 427

AUTHOR	Husband, David D.
TITLE	Development of an Audio-Tutorial Course for Non-Major Biology Students. Final Report.
INSTITUTION	South Carolina Univ., Columbia. Dept. of Biology.
SPONS AGENCY	National Center for Educational Research and Development (DHEW/OE), Washington, D.C.
BUREAU NO	BR-1-D-025
PUB DATE	Jun 72
GRANT	OEG-4-71-0044
NOTE	12p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Autoinstructional Programs; *Biology; *College Science; Conceptual Schemes; *Curriculum Development; Educational Programs; General Education; Instruction; *Program Descriptions

ABSTRACT

A one-semester Principles of Biology course designed for non-majors was developed to utilize the audio-tutorial method combined with the "mini-course" or concept pak approach. A total of 54 concept paks was developed, along with 12 basic lessons. Students were permitted to choose the specific concept paks that interested them most, to complete the requirements of the course. The philosophy of the course was favorably received by 85 percent of the students, and the effectiveness of the concept pak as a means of teaching was demonstrated to be above average. (Author/CP)

ED 065346

BR 1-D-025
PA 24

NCERD
SE

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY

FINAL REPORT
Project No. 1-D-025
Grant No. OEG-4-71-0044

David D. Husband
Department of Biology
University of South Carolina
Columbia, S. C. 29208

DEVELOPMENT OF AN AUDIO-TUTORIAL COURSE FOR NON-MAJOR BIOLOGY STUDENTS

FILMED FROM BEST AVAILABLE COPY

June 1972

U.S. Department of
Health, Education, and Welfare

Office of Education
National Center for Educational Research and Development
(Regional Research Program)

SE 014 427

Abstract

A grant was received for the development of a one-semester Principles of Biology course designed for non-majors. The course was developed to utilize the audio-tutorial method combined with the "mini-course", or concept pak approach. A total of 54 concept paks were developed, along with 12 basic lessons. Students were permitted to choose the specific concept paks that interested them most to complete the requirements of the course.

The philosophy of the course was favorably received by 85% of the students, and the effectiveness of the concept pak as a means of teaching was demonstrated to be above average.

FINAL REPORT

Project No. 1-D-025
Grant No. OEG-4-71-0044

DEVELOPMENT OF AN AUDIO-TUTORIAL COURSE FOR NON-MAJOR BIOLOGY STUDENTS

David D. Husband

Department of Biology

University of South Carolina

June 1972

The research reported herein was performed pursuant to a grant with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education
National Center for Educational Research and Development

TABLE OF CONTENTS

Introduction 1

Philosophy of Audio-Tutorial Approach. 1

The Concept pak Approach 2

Students Reactions 6

Evaluation 7

Conclusion 8

Table I: List of titles of Basic Lessons and Concept paks offered each week in Biology 110 at the University of South Carolina 4

Table II: Results of pre-test and post-test given for a random group of concept paks 7

Introduction

A single-semester Principles of Biology course designed for non-majors has been developed at the University of South Carolina. Anyone who is familiar with the vast quantity of subject matter that freshman biology entails would immediately recognize the enormous task involved in having to choose exactly what is to be taught and what is to be eliminated. A partial solution to this dilemma was achieved by combining the philosophies of an Audio-Tutorial approach to teaching and the Concept pak approach (Husband, 1970). This report will briefly describe these two philosophies, followed by a report on the success of the program.

Philosophy of Audio-Tutorial Approach

Students at all age levels vary greatly in their cognitive development regarding specific subject areas; individual differences in learning style and rate therefore require some mechanism for individualization of instruction. It is a well-known fact that all "learning must be done by the learner" and that the acquisition of concepts we wish to teach involves the cognitive development of individual students. Only if students had the same background of experiences and were capable of learning at the same rate could a fixed style and rate of instruction accommodate the needs of all students.

The Audio-Tutorial System is an attempt to individualize instruction by enabling the students to proceed independently in a study program and control the rate and intensity of study at each step. The basic element of the system is the independent study session. This study session is in a Learning Center which is open from 8:00 a.m. to 10:00 p.m. Monday through Friday. Each student comes in at his convenience and checks into one of fifty booths. Each booth is equipped with a tape recorder and all other items that might be helpful in learning the subject matter, such as texts, manuals, photographs, diagrams, charts, graphs, specimens, and experimental equipment. The voice of the senior professor tutors the student through a sequence of learning activities involving the use of the assembled items. Learning events include a great range of experiences such as reading from the text or manual, doing an experiment, collecting data, analyzing data, manipulating apparatus, watching a time-lapse movie, listening to brief discussions, and any other activity that will assist the student in accomplishing stated behavioral objectives.

The student is not required to spend a specific number of hours in the Learning Center each week--he spends as much time as it requires to learn the lesson at the level he aspires toward. Since a list of behavioral objectives accompanies each lesson, the student is aware of what is expected of him on his weekly quizzes. The author firmly believes that the success of the A-T approach depends heavily upon the provision of behaviorally stated objectives which serve to direct the students' activities and to specify the minimum level of acceptable performance.

In addition to the Independent Study Session, the Autio-Tutorial approach includes two other weekly activities: the Quiz Session and the General Assembly Session.

Quiz Session: Each student is scheduled for a one-hour "recitation" each week in which he is evaluated over the lesson presented in the Learning Center. There are two types of quizzes given: an oral and a written. The oral discussion follows a strict format designed to cause the student to learn the subject matter well enough to be able to teach it to his peers. A further discussion of the Quiz Session is given later in this paper.

General Assembly Session: This session most closely approximates the traditional lecture in the sense that the students gather in a large lecture hall at a specified time. However, the time is not used to give a lecture--it is used to clarify, integrate and direct the students' study. Also, special attractions such as guest speakers and long films can be presented at this time. The hourly exams are given in this session.

The Concept Pak Approach

Each discipline may be divided into various topics. This is very useful from a pedagogical point of view. Biology, for example, is usually taught as a series of "units", perhaps beginning with the concept of the cell and proceeding eventually to the principles of ecology. There are, of course, a number of alternative approaches to teaching biology (or any discipline for that matter), but regardless of the approach used, the teacher invariably "divides" the subject matter into sequential units, or concepts. Indeed, it could be said that all of Biology could be subdivided into small packets of information. Approximately 45 such packets have been developed for utilization in the non-majors course. The units are "single-concept" in nature and vary as to length and difficulty. I have chosen the term "Concept pak" to identify individual units.

All of the subject matter of our course is not presented in the form of Concept paks. Instead, the Concept paks are used to allow students to choose, among a variety of topics, a program of study which interest them most. Each week's lesson is presented in two parts: the Basic Lesson and Concept paks. Both parts are presented on the Audio-Tutorial format. Everyone in the course is required to complete the Basic Lesson which is the bulk of the week's assignment. It lays the foundation for further study in related areas. But after completion of a Basic Lesson, a student has accomplished only 3/4 ths of a normal assignment. The remainder of his study is taken as one or more Concept paks. For the purpose of giving the student an idea of how much time commitment is involved, each Concept pak is assigned a Unit value. Since the Basic Lesson amounts to 3/4 ths of the week's assignment, it is given the Unit value of 3.0. Thus it is necessary for each student to accomplish 1.0 Unit value per week in Concept paks in order to receive a satisfactory grade at the end of the semester. Whereas it is not mandatory that each

student complete 1.0 Unit each week, it is necessary that he complete 12 Units by the end of the semester. Table 1 lists the titles of the Basic Lessons and the Concept paks offered each week.

Testing Procedure: Each student is assigned to a one hour Integrated Quiz Session per week. The first half of the IQS consists of an oral discussion of the Basic Lesson just completed. Each student is graded by his instructor as either a "S" or "U" for the lesson under discussion. An "S" indicates at least a "C" level of learning and understanding has been accomplished. The second half of the IQS is spent taking a multiple choice objective-type quiz. The student must pass both the oral and the written to get credit for the Basic Lesson. A "U" must be erased by attending the special "make-up" session held each week by the senior instructor.

The Concept paks are also evaluated in the second half of the IQS. A written quiz is available for each concept pak which was offered during the week, and the student chooses the quiz(zes) which correspond(s) to the Concept pak(s) that he studied. The Concept paks are graded on a pass-fail basis, but for logistic reasons it is not possible to make up failed Concept paks.

How to Get An "A" or "B": Since the weekly quizzes are designed to measure "minimal level of acceptable performance", satisfactorily passing these quizzes means that the student is earning a "C" in the course. To earn an A or B he must accumulate points. These points are awarded when he demonstrated a level of learning which is higher than C. There are four different ways to earn A-B POINTS. One may utilize one or all of these methods to earn an A or B. The four methods are described below:

1. Hourly Exams: There are three hourly exams; each one consists of highly discriminating questions, i.e., A and B level (no give aways!) The questions are designed to test the student's ability to synthesize information to arrive at a solution to a specific problem, and to think scientifically. To receive a grade of B, at least 15 of the required 90 points must be earned on the A-B exams. An A requires at least 25 of the required 130 points to be earned on the A-B exams.

2. Bonus Articles: "A-B Points" may be gained by those students who read certain scientific articles assigned each week. A total of 2 points per article are possible. No more than 30 bonus points may be earned during the semester, and no more than 4 points can be earned during each Lesson.

3. Quest Assignments: Periodically students find a quest assignment or two on the Objective Sheet for a given lesson. Quests typically cover topics which are either not too well understood, controversial, or not covered very well in the text. The number of points which can be earned by satisfactorily completing a quest assignment varies with the topic (up to 5 points). The student's assignment is to research the topic at the library and to prepare a brief paper, using at least three reference works, which summarizes the topic or situation and presents the

TABLE I: List of titles of Basic Lessons and Concept paks offered each week in Biology 110 at the University of South Carolina.

NO.	BASIC LESSON	CONCEPT PAK	UNIT VALUE
1	I. The Nature of Science	Bacteria	1.0
	II. Levels of Organization	Viruses	1.0
	III. Survey of the Plant Kingdom	Seeds	1.0
2	Survey of the Animal Kingdom	Venereal Disease	.5
		India's Population Crisis	1.0
		Dissection: Earthworm	.5
		Dissection: Clam	.5
		Dissection: Crayfish	.5
		Dissection: Frog	.5
3	Chemical Basis of Life	Origin of Life	1.0
		Darwin's Theory	.5
		Enzymes	1.0
		India's Population Crisis	1.0
4	I. Cellular Basis of Life	The Cell Membrane	.5
	II. Physical Phenomenon	The Ultrastructure of Cellular Organelles	1.5
		Plants & Water	1.5
		Soil & Water	.5
5	Transformation of Energy: PHOTOSYNTHESIS	The Path of Carbon in PHS	1.0
		The Role of Light in PHS	1.0
		Mineral Nutrition in Plants	.5
		India's Population Crisis	1.0
6	Transformation of Energy: RESPIRATION	Synthesis & Digestion in Plants	1.0
		Birth Control Mechanism	1.5
		Anatomy of Digestive System	1.0
7	Principles of Ecology	Pollution	1.0
		Population & Food	1.0
		Ecological Survey: POND	1.0
		Biomes & Determining Factors	.5
8	Plant Growth & Development	Light & Growth of Plants	1.0
		Photoperiodism in Plants	1.0
		Twigs & Buds	.5
		Wood Anatomy	.5
		Birth Control Mechanisms	1.5
9	Animal Growth & Development	Circulatory System	1.0
		Blood	1.0
		Chemistry of Digestion	1.0
		Gas Exchange	.5
		Action of the Kidney	.5
10	I. Mitosis & DNA Duplication	Muscle: Structure & Function	1.0
	II. Protein Synthesis	The Vertebrate Skeleton	.5
	III. Meiosis & Gametogenesis	The Endocrine System	1.5
		Experimental crosses with Drosophila: Part I	.5
		The Hallucinogenic Drugs	1.0

TABLE 1 (continued)

NO.	BASIC LESSON	CONCEPT PAK	UNIT VALUE
11	Genetics	Flower: Structure & Function	.5
		Life Cycles (Plants)	1.0
		The Modern Concept of the Gene	1.5
		Experimental Crosses with Drosophila: Part II	1.0
12	Evolution	The Color of Man	1.0
		Plant Identification Field Trip	1.0
		The Evolution of Man	1.0
		Human Genetics	.5
		Human Birth Defects	.5

views of the sources, the view the student accepts, and the reasons for his acceptance.

4. Bonus Concept paks: Everyone is required to satisfactorily complete 12 Units Concept paks by the end of the semester. Each Concept pak that is completed beyond this minimum contributes toward a higher grade at the rate of 10 points/1.0 Unit. Students are not allowed to use more than 60 Bonus Concept pak points toward a B, and not more than 85 toward an A.

Students Reactions:

The numerous favorable comments received from students suggests that the basic philosophy of the "Concept pak" approach is well received. Results on an attitudinal questionnaire were:

15% "Concept paks" should be abandoned
85% "Concept paks" should be continued

Some of the reasons given for abandoning the concept pak idea were:
"They are too hard."
"Too many are required for a C student."
"Why should we have to do extra work if we are just working for a "C"?"

One of the most difficult aspects to get across of the Concept pak approach is the idea that the concept pak is not extra work. Since the week's Basic Lesson is shorter in content, the requirement to complete one C.P./week is not extra work, but necessary in order to be exposed to a full lesson. The author feels that since the two lessons take place in two different rooms, necessitating the movement from one to the other, that there is a psychological resistance to complete a C.P., especially since the Basic Lesson is usually 3 to 4 hours in length. One way to combat this problem will be to shorten the Basic Lesson even further, and then require 2 C.P.'s per week.

The "learning for Mastery" philosophy was also acceptable to a sizable portion of the students. This concept requires that each Basic Lesson and Concept pak be learned at a "minimum level of acceptable performance"--i.e., a "C", in order to receive credit in the course. In other words, it is not permissible to average the failure of one week's lesson with an A level performance on another week's lesson and arrive at a C average. Instead, one must achieve a C on each week's lesson or else he fails the course. There is no question but that this concept represents a raising of standards in the course as a whole. However, it is especially pleasing to learn of students reaction--50% agreed with the new standards, and 50% thought it was too rigid and wished they were relaxed.

The following quotations represent a cross section of unsolicited comments received in our "Suggestion box".
"A-T biology is one of man's greatest innovations, if only more

courses could be taught this way."
"This program rates an A+ with me. I took biology last semester by the conventionally method and failed it. But your system makes one want to study."
"My knowledge and interest in biology has increased greatly. I was treated fairly and on a personal basis. It is the best course I've ever taken."
"I'm learning more, I'm learning faster, and I'm enjoying learning."
"Would you please be a little more direct in your discussion on the tape?"
"When are we going to get off the photosynthesis and respiration bit and start studying things more relevant?"

Achievement on Concept paks.

To test the effectiveness of the Concept pak approach insofar as learning is concerned, the following procedure was used: a random group of concept paks were chosen each week to be tested. As students came into the Learning Center and checked into a booth containing one of the chosen C.P.'s, he was immediately given a pretest to determine his level of understanding of the material prior to the completion of the study. These scores were then compared to the results on the actual quiz given in the Integrated Quiz Session. Table II below summarizes this evaluation.

TABLE II

Mean correct responses of students to comparable tests on ten concept paks before and after study.

Concept pak	Before Study	After Study	Mean Increase
21	38.2%	77.0%	38.8%
22	47.9%	73.6%	25.7%
27	53.3%	90.0%	36.7%
28	57.0%	81.0%	24.0%
30	52.3%	78.5%	26.2%
39	66.4%	91.1%	24.7%
43	65.0%	96.7%	31.7%
46	52.5%	80.0%	27.5%
61	46.4%	83.6%	37.2%
71	46.7%	68.3%	21.6%

Conclusion

Without reservation, it can be said that the combining of the Audio-Tutorial approach to teaching with the Concept pak approach was a success. It allowed each student to choose from a wide variety of topics those which were most appealing to him, thus he was able to tailor the course to his own needs. It also permitted students to arrive at his own pre-selected goal of attainment. The "learning for mastery" concept insured quality performance on the topics he chose, thus it is reasonable to believe that each student has acquired a bona-fide 4 semester hours of laboratory science credit regardless of the specific concept pak which he may have chosen to complete.

The University of South Carolina is continuing the offering of this course along this method. The principle investigator has received a supplementary grant from the Office of the President to continue development of concept paks and to improve some of those already in service. A proposal has been formulated to offer variable credit in the course, to reflect the total quantity of subject matter completed. This proposal is awaiting discussion in the appropriate University Committees.